

## CLASS VI AOR BOUNDARY CONDITIONS DESCRIPTION ELK HILLS 26R PROJECT

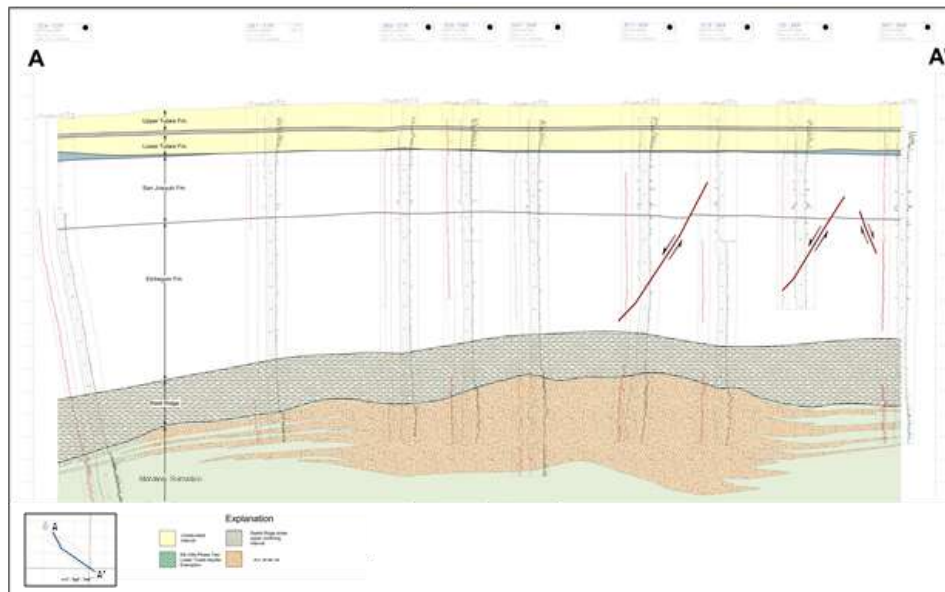
### AoR Boundary Conditions

#### *Site Geology and Hydrology*

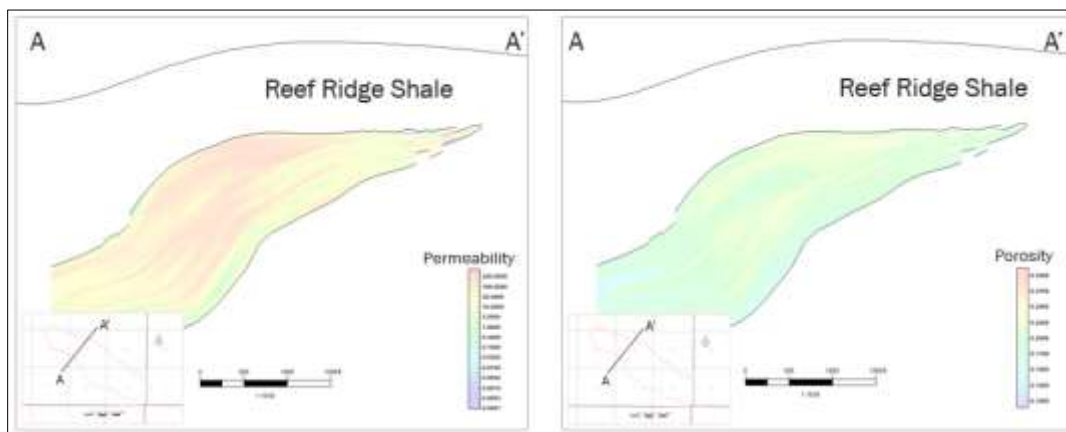
The 31S field is a northwest-southeast trending anticlinal structure located in the Elk Hills Oil Field within the San Joaquin Valley of California, producing oil and gas from the Miocene-aged Monterey Formation. The reservoir sands are composed of a series of stacked turbidite sands, interbedded with siliceous shales and clays. The Monterey Formation 26R sands, present in the southwestern portion of the field pinch-out along strike (Figure 1) and on top of the structure (Figure 2).

The Monterey Formation sands are bound above by the regional Reef Ridge Shale, and below by the Lower Antelope Shale Member of the Monterey Formation. The Reef Ridge Shale is a deep marine, clay-rich interval, deposited regionally with average gross thicknesses of ~1,000', and has a very low matrix permeability. Its competence in confining upward fluid movement is established by its demonstrated historical performance as the regional seal for hydrocarbon accumulation within the Monterey Formation, not only for the Monterey Formation 26R, but for all Monterey accumulations in the greater Elk Hills area.

**Figure 1: Cross-section A-A' showing lateral Monterey Formation 26R sand pinch-out.**



**Figure 2: Reservoir quality of the Monterey 26R reservoir. Note the sands pinch-out from A to A'.**



## Reservoir Development

The CalCapture Class VI injection wells will target injection in the Monterey Formation 26R sands. The Monterey Formation 26R oil and gas reservoir was discovered in the 1940's and has been developed with primary production and pressure maintenance (Table 1). Gas and water injection supported reservoir pressures and helped maintain oil production. Starting in the year 1998, pressure maintenance ceased, and the gas cap reservoir was “blown-down”, depleting the reservoir pressure. Since blow-down, reservoir pressure has remained at 150 - 300 PSI, indicating a closed reservoir with minimal water influx and/or connection to an aquifer.

**Table 1: Production and injection volumes for the Monterey Formation 26R reservoir.**

Process	Phase	Volume
Production	Oil	222 million barrels
	Gas	1,244 billion cubic feet
	Water	81 million barrels
Injection	Water	114 million barrels
	Gas	841 billion cubic feet

## Boundary Conditions

No-flow boundary conditions were applied to the Monterey Formation 26R reservoir in the computational modeling. These conditions were based on the following:

1. The overlying Reef Ridge Shale is continuous through the area, has a low permeability (less than 0.01 mD) and has confined oil and gas operations, that include the injection of water and gas, since discovery.

2. Performance data from operating the Monterey Formation 26R oil and gas reservoir indicates no connection to an active aquifer.
  - i. Historical production data (Figure 3) shows minimal water production, supporting limited aquifer influx.
  - ii. Gas injection and subsequent gas blow-down (Figure 3) proves lateral and vertical confinement by demonstrating that gas did not migrate out of the reservoir.
  - iii. Pressure in the reservoir is 150 - 300 PSI, demonstrating minimal to no aquifer influx and subsequent increase in pressure.

**Figure 3: Monterey Formation 26R production and injection data.**

